THE DESMIDS OF THE WEST END OF LAKE ERIE[1,2]

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INTRODUCTION

For several years the writer has had the opportunity to study the desmids of the Island Region of the west end of Lake Erie. First in 1933, and later while a member of the staff of the Franz Theodore Stone Laboratory on Gibraltar Island in Put-in-Bay Harbor during the summers of 1938, 1940, and 1941. Collections made from the open lake, shore margins, and from ponds and beach pools on the Islands were augmented during the interim from 1933 to 1938 by collections made by Tiffany during his work on "The plankton algae of the west end of Lake Erie" (1934) and "The filamentous algae of the west end of Lake Erie" (1937). The writer gratefully acknowledges these collections, as well as many collections placed at his disposal by members of the fresh-water algae classes at the Stone Laboratory.

The writer hopes that this report, the latest in a series on the algae of the region will be not only of taxonomic interest, but helpful to the student of aquatic biology. For the benefit of the latter the paper has been prepared in somewhat greater detail than would otherwise be necessary.

Two groups remain to be reported. They are the Dinophyceae (which has been only superficially worked) and the Bacillariophyceae. Of the two classes, the representatives of the latter are far more numerous, and at times constitute an important bulk of the plankton. It is hoped that in the near future this group may receive the attention that its importance deserves.

DESMID HABITATS OF THE REGION

The survey was limited to a portion of an area generally known as the Island Region of the west end of Lake Erie and is shown on the accompanying map. Although some collections from islands north of this area were examined, they have not been reported.

South Bass Island, on which is located the town of Put-in-Bay, is the largest of the Bass Islands group, and is of little interest algologically beyond the protected inlets located around Put-in-Bay Harbor. There are three of these inlets having semi-pond characteristics and known as Terwilligers Pond, Squaw Harbor, and Hatchery Bay. These are protected considerably from northeast storms by Gibraltar Island and from northwest and southwest storms by the land adjoining the harbor. This protection, along with shallow water, makes them excellent habitats for the higher aquatics. In general they contribute interesting desmid collections, and are especially good for species of *Cosmarium*.

Middle Bass Island, which lies approximately one mile due north of South Bass, contains three shallow ponds, referred to in this report as Wehrle, Fisher, and Haunk. These ponds have mud bottoms and are choked to such an extent with aquatics that, during low water levels, they become veritable marshes whose weedy margins afford the quiet water desirable for desmid collecting.

North Bass Island, slightly more than one mile north of Middle Bass, contains two large ponds or marshes, their classification dependent upon the lake level.

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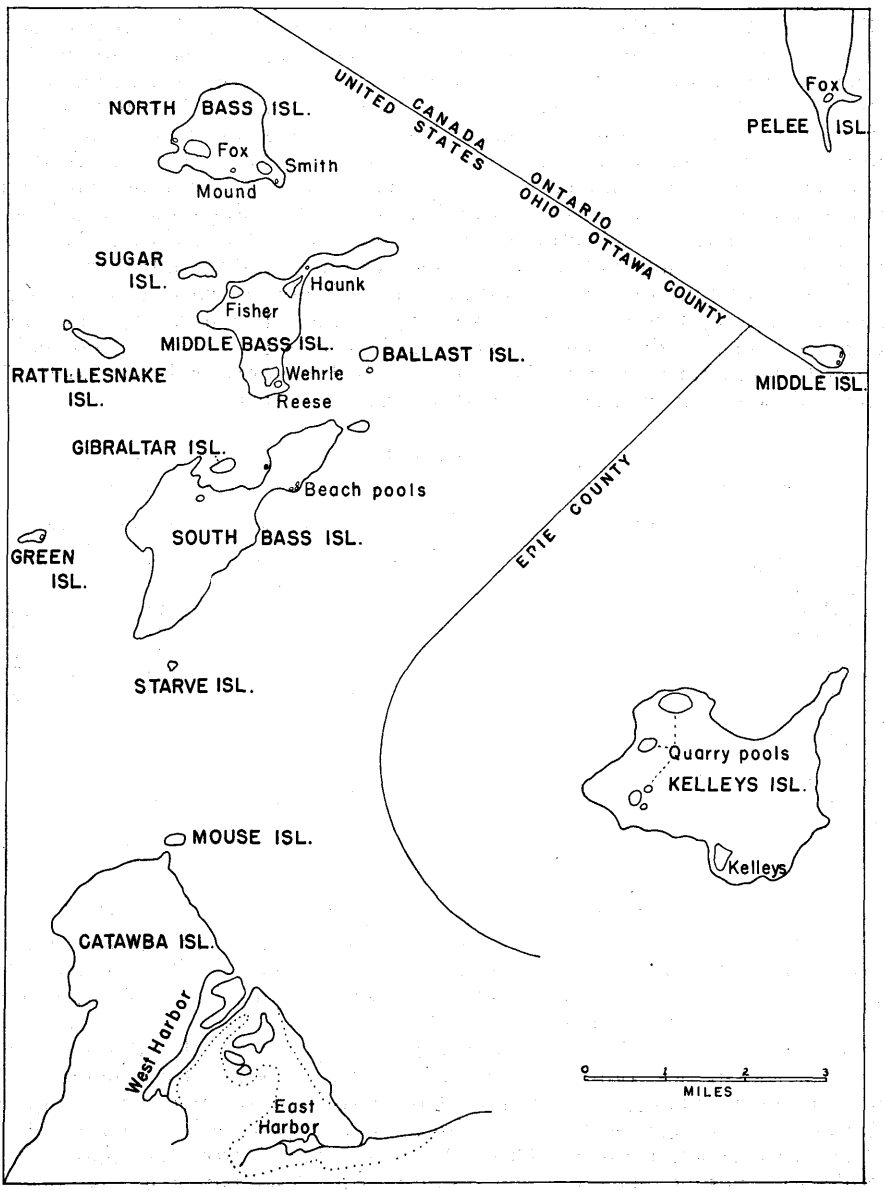
Fox Pond is a natural depression, while Smith Pond is an abandoned carp propagation pond. A third, known as Mound Pond, is located near the south shore dock and exists only during the wetter seasons. A few beach pools in addition to these three ponds constitute the desmid habitats of the Island.

Kelleys Island lies approximately six miles S. E. of South Bass. Although there are some swamp areas, the unique habitats of the Island are the numerous



Map of the Islands Region of the Western End of Lake Erie.
(Adapted from the Put-in-Bay and Kelleys Island Quadrangles of the United States Geological Survey.)

abandoned quarries. The water in these varies from a few inches in depth to forty feet. The desmids, although never abundant in these quarries, appear quite frequently in the bottom ooze of the shallow water.

Pelee Island in Canadian water offers several varied habitats such as drainage ditches, abandoned quarries, canals, and Fox's Marsh; the latter, an extensive peaty area almost entirely choked with aquatic macrophytes, being the most interesting.

East and West Harbors are on the east shore of the mainland peninsula of Catawba Island which lies directly south of South Bass. These are the largest confined bodies of water in the region (opening into Lake Erie only through narrow inlets) and with their weedy margins may be considered as shallow lakes. East Harbor, being more readily accessible because of regular field trips scheduled from the Laboratory, has received more attention than West Harbor. Aside from the regularly traveled channels, the water is shallow and at times one finds it nearly impossible to maneuver a boat because of the abundance of submerged and floating aquatics. Collecting becomes merely a matter of rinsing the desmids from the leaves and stems of these macrophytes into suitable containers.

Of less general interest and importance are the habitats existant on the smaller islands of Starve, Green, Rattlesnake, Sugar, Ballast, Gibraltar, and Middle. The latter, which is due south of Pelee, is in Canadian water. These habitats are mostly temporary and may best be described as spray or beach pools whose existence depends on the frequency and severity of storms.

TABLE I

Locality	Genera	Species	Varieties
Terwilligers Pond	1	1	..
Hatchery Bay	2	5	2
Squaw Harbor	5	21	10
Wehrle Pond	4	11	9
Haunk Pond	4	15	7
Fisher Pond	3	8	7
Smith Pond	4	11	2
Fox Marsh	3	2	1
Mound Pond	1	1	..
Kelleys Island	6	24	12
Pelee Island	5	13	11
East and West Harbors	9	28	9
Other Habitats	2	7	6

THE RELATIVE ABUNDANCE OF DESMIDS

Prior to the completion of this survey, 460 species, varieties and forms of algae distributed in 141 genera were listed for the region. Tiffany (1934, 1937), Taft (1942). With the completion of the present survey, the number is increased to 599 species, varieties and forms distributed in 154 genera. This number does not include the unverified desmid reports by earlier workers. The desmids account for 139 of the species total, or approximately 23%. While these figures do not indicate a rich desmid region, they show that relatively the desmids are an important constituent of the algal flora. An entirely different picture is presented when an analysis of the genera is made. Of the 154 genera known from the region, only 13, or 8.4%, are desmid genera. The result of this descrepancy is that one finds species representing one, two, or at the most, three genera predominant in the collections. Representatives of genera other than *Closterium*, *Cosmarium*, and *Staurastrum* are not common. The explanation of this phenomena is not entirely

clear although to one familiar with the region and with desmid distribution the data are not exactly irrelevant. Desmids are usually encountered in numbers (both genera and species) only in sandy or boggy regions where the waters are acid. Limestone regions with their subsequent hard water, are notoriously poor in the desmid flora they support. Consequently the Island Region of the west end of Lake Erie, with its alkaline waters (pH 7 to pH 10) should not be expected to yield a rich desmid flora. It is this that makes the large number of species present an interesting problem in distribution.

Table I summarizes the relative abundance of the genera, species, and varieties of desmids in the various locations from which collections were made.

PREVIOUS REPORTS ON LAKE ERIE DESMIDS

There have been no reports dealing exclusively with the desmids of the region. Papers which have included them along with other algae as well as vascular plants are those of Pieters (1901), Snow (1902) and Chandler (1940). As Tiffany (1934, 1937) did not include them, this is the first attempt at a comprehensive study of the group.

Unfortunately many of the previously reported species have not reappeared in the writers collections, although in some instances varieties of the species have been collected. This may partially be due to the fact that a number of the earlier reports were from the Portage River, which lies outside the arbitrary limits set for this survey. These unverified records are included in the following list, but are not described or figured.

Closterium acutum var. *linea* Klebs.
(*Closterium pronum* Bréb. var. *linea* Klebs, Pieters, The plants of western Lake Erie, 1901, p. 79.)
Closterium lineatum Ehren.
Cosmarium angulosum var. *concinnum* (Rab.) W. & G. S. West.
(*Cosmarium meneghinii* var. *concinnum* Rab., Snow, The plankton algae of Lake Erie, 1902, p. 392.)
Cosmarium brébissonii Menegh.
Cosmarium connatum (Bréb.) DeBary.
(*Disphinctium connatum* (Bréb.) DeBary, Pieters, The plants of western Lake Erie, 1901, p. 79).
Cosmarium crenatum Ralfs.
Cosmarium depressum Lund.
Cosmarium euastroides N.
Cosmarium kjellmanii Wille.
Cosmarium margaritiferum Menegh.
Cosmarium moniliforme Ralfs.
Cosmarium nitidulum De Not.
Cosmarium ornatum Ralfs.
Cosmarium punctulatum Bréb.
Cosmarium pygmaeum Archer.
Cosmarium ralfsii (Bréb.) Lund.
(*Pleurotaenopsis ralfsii* (Bréb.) Lund., Pieters, The plants of western Lake Erie, 1901, p. 79.)
Cosmarium reniforme var. *compressum* Nordst.
Cosmarium tetraophthalmum Kuetz.
Cosmarium tinctum Ralfs.
Euastrum binale Ralfs.
Euastrum elegans Kuetz.
Euastrum verrucosum Ehren.
Staurastrum avicula Bréb.
Staurastrum brebissonii Archer.
Staurastrum dejectum Bréb.
Staurastrum dilatum Ehren.
Staurastrum gracile Ralfs.
Staurastrum oblongum N.
Staurastrum teliferum Ralfs.
Xanthidium antilopeum Kuetz.
Hyalotheca dissiliens Bréb.
Onychonema laeve Nordst. var. *minus* Borge.
Onychonema filiforme (Ehren.) R. & B.
(*Sphaerozosma filiforme* Rab., Snow, The plankton algae of Lake Erie, 1902, p. 392.)

THE DESMIDS

The name "desmids" as used in this report assumes the original meaning and applies to the organisms now grouped in two Families, the Mesotaeniaceae and the Desmidiaceae within the Order *Zygnematales* of the Class *Chlorophyceae*. In general they are unicellular plants of varied form, symmetrical in three planes at right angles to each other. Most of the members of the *Desmidiaceae* are divided into two equal semi-cells by a more or less prominent median constriction. Those of the *Mesotaeniaceae*, while never distinctly constricted, usually have the protoplasm and the plastids divided into two equal halves. The members of the *Desmidiaceae* are further separated from the *Mesotaeniaceae* by having their walls composed of two over-lapping halves instead of being continuous, and with a differentiated outer layer with pores.

Because of the general availability of standard references concerning this group, a complete taxonomic treatment has not been attempted by the writer. However, the problems of the student of aquatic biology have been considered and the report prepared accordingly. A key to the genera, as well as brief descriptions of the species, has been included. Illustrations are from the writer's original camera lucida drawings.

Keys to the species, if they attempt to give the necessary differentiating characters, become exceedingly complex, and subsequently defeat their purpose of simplification. Therefore such keys have been excluded. The student, after determining the genus, should work by constant reference to descriptions and figures. The identification of a species is best attempted from a number of individuals which will give the variations, instead of from what may turn out to be a non-typical individual.

NEW SPECIES AND VARIETIES

Seven species and seven varieties have been named and described, while one form has been given varietal rank.

Closterium eriense sp. nov.
Euastrum ohioense sp. nov.
Cosmarium eriense sp. nov.
Cosmarium franzstonii sp. nov.
Cosmarium impressulum var. *suborthogona* (W. & G. S. West) Comb. nov.
Cosmarium nitidulum var. *pseudovalidum* var. nov.
Cosmarium reniforme var. *seminudum* var. nov.
Cosmarium subnudiceps var. *granulatum* var. nov.
Cosmarium subraciborskii sp. nov.
Cosmarium viride var. *compressum* var. nov.
Staurastrum biarcuus sp. nov.
Staurastrum bicoronatum var. *tridentatum* var. nov.
Staurastrum brevispinum var. *canadense* var. nov.
Staurastrum peleii sp. nov.
Staurastrum polytrichum Perty var. *ornatum* var. nov.

KEY TO THE GENERA

1. Filamentous 11
1. Unicellular (sometimes in readily disassociating filaments) 2
   2. Cell length not more than twice the breadth 8
   2. Cell length twice the breadth, or more 3
3. Without a median constriction 4
3. With a more or less distinct median constriction 7
   4. Chloroplasts ribbon-like, axial, straight; cells in readily disassociating filaments, **Gonatozygon**
   4. Chloroplasts not ribbon-like 5
5. Chloroplasts substellate, 2 per cell; cells sometimes slightly curved ..... **Cylindrocystis**
5. Chloroplasts longitudinally ridged, two per cell 6
   6. Cells straight, nearly cylindrical, apices broadly rounded ..... **Penium**
   6. Cells usually strongly curved, apices attenuated ..... **Closterium**

7. Median constriction indistinct; cells nearly cylindrical, apices broadly rounded; semi-cells not inflated at the base.....**Penium**
7. Median constriction distinct; cells cylindrical, apices broadly rounded to truncate; base of semi-cell inflated, not plicate.....**Pleurotaenium**
8. Cells compressed..... 9
8. Cells radially symmetrical, if compressed then with apical angles produced into divergent processes.....**Staurastrum**
9. Margins of semi-cells variously lobed, apex sometimes incised.....10
9. Margins of semi-cells seldom lobed (sometimes undulate or crenate), sometimes with spines; apex not incised.....**Cosmarium**
10. Lateral lobes separated by shallow incisions, apex usually deeply incised; cell wall variously ornamented.....**Euastrum**
10. Lateral lobes separated by deep incisions, apex with shallow incision, or retuse, **Micrasterias**
11. Cells united by special apical processes, compressed; filaments not twisted..**Sphaerozosma**
11. Cells not united by apical processes.....12
12. Cells triangular in vertical view, median constriction distinct; filaments twisted, **Desmidium**
12. Cells not triangular in vertical view.....13
13. Cells circular in vertical view, median constriction indistinct.....**Hyalotheca**
13. Cells elliptical in vertical view, median constriction deep.....**Spondylosium**

SPECIES LIST

Gonatozygon De Bary 1856

Cells cylindrical, length 10–20 times the diameter, not constricted, apices truncate and slightly inflated, in filaments which readily disassociate. Chloroplasts two, axial, narrow and undulate, pyrenoids numerous.

1. *Gonatozygon kinahani* (Arch.) Rab. (Pl. I, Fig. 1) L. 135–195μ, w. 11–12μ. Squaw Harbor.
2. *Gonatozygon monotaenium* De Bary (Pl. I, Fig. 2) L. 101–190μ, w. 9–10μ. Kelleys Isl. quarry pools.

Cylindrocystis Menegh. 1838

Cells cylindrical, sometimes slightly curved, length varying to 3½ times the diameter, unconstricted, apices rounded, embedded in mucilage; with two axial, stellate chloroplasts; pyrenoids large, one in each chloroplast.

1. *Cylindrocystis brebissonii* Menegh. var. *minor* W. & G. S. West (Pl. I, Fig. 3) L. up to 42μ, w. 12–13μ. Partially submerged rocks, Gibraltar.

Penium Bréb. 1844

Cells cylindrical to fusiform, with or without a slight median constriction, apices rounded or subtruncate; chloroplasts one or two in each semicell, each a central mass with radiating longitudinal plates, plates entire along the margins; pyrenoids axial, one or more; cell wall with pores.

1. *Penium margaritaceum* (Ehren.) Bréb. (Pl. I, Fig. 4). L. 115–184μ, w. 21–23μ. East Harbor, Kelleys Isl., Manila Bay.

Pleurotaenium Naeg. 1849

Cells straight, elongated, cylindrical, constricted, semicells with a non-plicate, inflated base; apex with or without tubercles; chloroplasts numerous, parietal, longitudinal bands.

1. *Pleurotaenium ehrenbergii* (Breb.) De Bary (Pl. I, Figs. 5, 6). L. 270–520μ, w. at base 27–30μ, w. at middle of semicell 25–35μ, w. at apex 16–18μ, isth. 21–23μ. Pelee.
   Many individuals showed a distinct shortening and tumidness of the semicells, but there were all gradations between these and the typical forms.
2. *Pleurotaenium trabecula* (Ehren.) Naeg. (Pl. I, Fig. 7). L. 360–580μ, w. at base 26–35μ, w. at apex 20–23μ. Wehrle, Fisher, Squaw Harbor.

Closterium Nitzsch 1817

Cells elongate, more or less attenuate, slightly curved to strongly lunate, unconstricted; ends of cells rounded, truncate or sharply pointed; cell wall smooth or striate, colorless to brown;

one axial chloroplast per semicell, each with longitudinal, radiating ridges; pyrenoids few to many, axial or scattered; each end of the cell with a vacuole containing moving granules of calcium sulphate.

1. *Closterium acerosum* (Schrank) Ehren. (Pl. I, Fig. 8). Cell wall smooth, colorless, often becoming yellow when old; chloroplast with 14–16 ridges and an axial series of about 10 pyrenoids. L. 340–475μ, w. 40–60μ. Squaw Harbor, Hatchery Bay, East Harbor.
2. *Closterium calosporum* Wittr. (Pl. I, Fig. 9). Cell wall smooth and colorless. L. 160μ, w. 13μ, zygospore about 32μ. Kelleys Isl.

   This species is very similar to *Cl. dianae* but the spore is distinctive.
3. *Closterium dianae* Ehren. (Pl. I, Fig. 10). Cell wall smooth, very pale yellow; chloroplast with about 4 ridges and 3–4 pyrenoids. L. 147–160μ, w. 13–14μ. Kelleys Isl.
4. *Closterium eboracense* (Ehren.) Turner (Pl. I, Fig. 11). Cell wall smooth and colorless; chloroplasts with about eight ridges and 4 pyrenoids. L. 220μ, w. 47μ. Squaw Harbor.
5. *Closterium ehrenbergii* Menegh. (No figure). Cell wall smooth and colorless; chloroplasts with 10–12 ridges and numerous scattered pyrenoids. L. 420–590μ, w. 80–101μ. Wehrle, Fisher, Haunk, Terwilliger's, East Harbor, Fox.
6. **Closterium eriense** Taft n. sp. (Pl. I, Fig. 12). Cells of medium size, seven times longer than broad, strongly curved (almost 180 degrees of arc), inner margin concave, not tumid, gradually attenuated to broadly rounded apices; cell wall smooth and very light yellow; chloroplasts? L. 215μ, w. 30μ, w. of apices 10μ. Squaw Harbor.

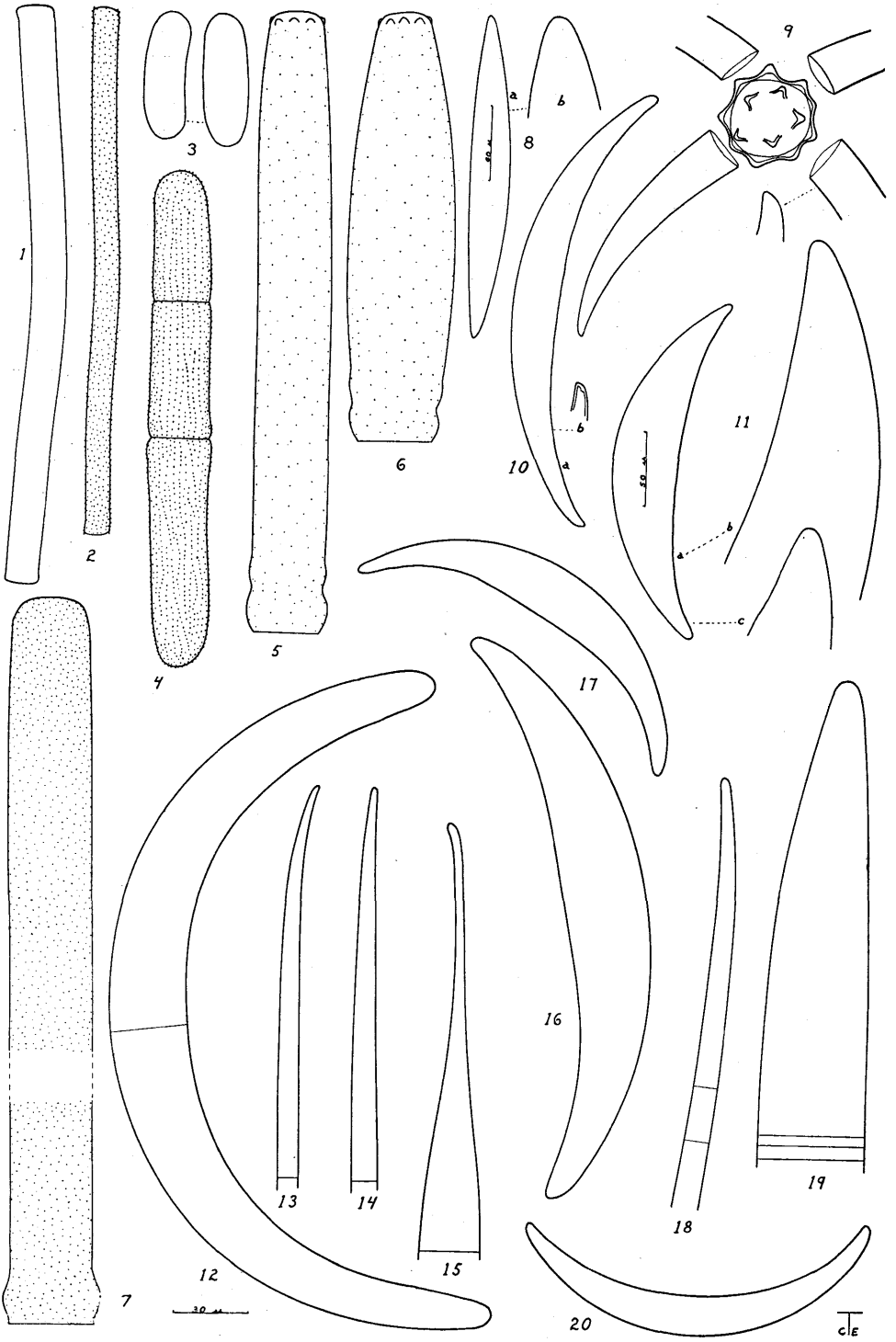
   Cl. mediocre, cellulis diametro 7 plo longioribus, ventre concavo, non distincte tumido, gradatim attenuatis apicibus versus, apicibus rotundatis; membrana glabra, luteola. Long. 215μ, lat. 30μ, lat. apic. 10μ.

   Although this must stand at the present as an incompletely described species because of the advanced decomposition of the chloroplasts when collected, it differs sufficiently to be given specific rank. Its greater size and the broadly rounded apices separate it from *Cl. parvulum* var. *angustum* W. & G. S. West. It is larger and less curved than *Cl. cynthia* var. *curvatissimum* W. & G. S. West.
7. *Closterium gracile* Bréb. (Pl. I, Fig. 13). Cell wall smooth and colorless; chloroplasts with about 6 pyrenoids. L. 211μ, w. 7μ. East Harbor.
8. *Closterium idiosporum* W. & G. S. West (Pl. I, Fig. 14). Cell wall smooth and colorless; chloroplasts faintly 4-ridged, with about 5 pyrenoids. L. 197–232μ, w. 9–10μ. Wehrle.
9. *Closterium kützingii* Bréb. (Pl. I, Fig. 15). Cell wall finely striate (about 12 striae per 10μ), becoming dark yellow when old; chloroplasts with about 4 ridges and 6 pyrenoids. L. 273–380μ, w. 20μ. Pelee.
10. *Closterium leibleinii* Kuetz. (Pl. I, Fig. 17). Cell wall smooth and colorless, sometimes very light yellow; chloroplasts with about 6 ridges and 3 pyrenoids. L. 115–121μ, w. 18–21μ. Haunk, Hatchery Bay, East Harbor.

    This species is variable as to size and curvature, especially the latter.
11. *Closterium lunula* (Muell.) Nitz. var. *coloratum* Klebs. forma? (Pl. I, Fig. 19). Cells quite large, between 7–10 times longer than broad, inner wall straight, outer wall broadly convex; apices broadly rounded; cell wall finely striate (10 striae per 10μ), yellow brown; chloroplasts with 10–12 ridges and numerous scattered pyrenoids. L. 330–375μ, w. 37–44μ. Squaw Harbor.

EXPLANATION OF PLATE I

Fig. 1. *Gonatozygon kinahani*. Fig. 2. *Gonatozygon monotaenium*. Fig. 3. *Cylindrocystis brebissonii* var. *minor*. Straight and curved cells. Fig. 4. *Penium margaritaceum*. Figs. 5, 6. *Pleurotaenium ehrenbergii*. Fig. 7. *Pleurotaenium trabecula*. Fig. 8a, b. *Closterium acerosum*. 8a, outline of cell; 8b, apex. Fig. 9. *Closterium calosporum*, with zygospore. Fig. 10a, b. *Closterium dianae*. 10a, outline of cell; 10b, detail of apex. Fig. 11a, b, c. *Closterium eboracense*. 11a, outline of cell; 11b, semicell; 11c, apex. Fig. 12. *Closterium eriense*. n. sp. Fig. 13. *Closterium gracile*. Semicell. Fig. 14. *Closterium* idiosporum. Semicell. Fig. 15. *Closterium kützingii*. Semicell. Fig. 16. *Closterium moniliferum*. Fig. 17. *Closterium leibleinii*. Fig. 18. *Closterium macilentum*. Fig. 19. *Closterium lunula* var. *coloratum* forma? Fig. 20. *Closterium parvulum*.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As this form is only one-half or one-third as broad as *Cl. lunula* var. *coloratum* there is some doubt as to its correct systematic position. Because of the close resemblance in regard to other characters, it will be left as a form of the variety *coloratum* Klebs.

12. *Closterium macilentum* Breb. (Pl. I, Fig. 18). Cell wall smooth and colorless (very faintly yellow in old specimens); chloroplasts with 8–10 pyrenoids. L. 270μ, w. 7μ. Smith.
13. *Closterium moniliferum* (Bory) Ehren. (Pl. I, Fig. 16). Cell wall smooth and colorless; chloroplasts with about 6 ridges and 5–6 axial pyrenoids. L. 204–310μ, w. 27–53μ. Fisher, Smith, Squaw Harbor, Hatchery Bay, East Harbor.
14. *Closterium parvulum* Naeg. (Pl. I, Fig. 20). Cell wall smooth and colorless; chloroplasts with 5–6 ridges and about 4 pyrenoids. L. 110–119μ, w. 13–18μ. Wehrle, Smith, Fox, Squaw Harbor.
15. *Closterium parvulum* var. *angustum* W. & G. S. West (Pl. II, Fig. 1). Cells much narrower and usually shorter than in the species, curvature greater; otherwise similar. L. 96–121μ, w. 5–7μ. Hatchery Bay, Kelleys Isl., East Harbor.
16. *Closterium praelongum* Bréb. (Pl. II, Fig. 2). Cell wall nearly colorless to yellow, appearing smooth (Krieger, 1935, reports 15 striae per 10μ when the wall is examined with oil immersion lens), chloroplasts with about 5 ridges and 10 pyrenoids. L. 860μ, w. 24μ. Pelee.
17. *Closterium praelongum* var. *brevius?* Nordst. (Pl. II, Fig. 3). Similar to the species but with smaller dimensions. L. 365–410μ, w. 18μ. Fisher.

    The specimens were intermediate in size between the species proper and the variety *brevius*. They have been assigned to the variety on the basis of the ratio of the axes.
18. *Closterium pritchardianum* Arch. (Pl. II, Fig. 4). Cell wall finely striate (9–10 striae per 10μ), striae composed of fine punctae, often subspiral, color yellow to red-brown; chloroplasts with 6–8 ridges and about 8 axial pyrenoids. L. 334–530μ, w. 21–37μ. Haunk, Fisher, Mound, Squaw Harbor, Hatchery Bay.
19. *Closterium subulatum* (Kuetz.) Breb. (Pl. II, Fig. 5). Cell wall smooth and colorless; chloroplasts with 3–4 pyrenoids. L. 128–188μ, w. 7–10μ. Fisher, Smith.
20. *Closterium venus* Kuetz. (Pl. II, Fig. 6). Cell wall smooth and colorless; chloroplasts ridged, with 2 (sometimes 3) pyrenoids. L. 76–85μ, w. 9–14μ. Haunk.
21. *Closterium venus* var. *incurvum* (Bréb.) Krieger (Pl. II, Fig. 7). Cell wall smooth and colorless, rarely yellowish when old; chloroplast with 3–4 pyrenoids. L. 39–66μ, w. 7–12u. Haunk, Smith, Squaw Harbor, East Harbor.

Euastrum Ehren. 1832

Cells variable in size, longer than broad, sometimes about as broad as long, strongly compressed, deeply constricted, sinus linear; semicells usually pyramidate, lateral margins variously lobed, center of semicell with one or more protuberances, apex usually truncate with an incision

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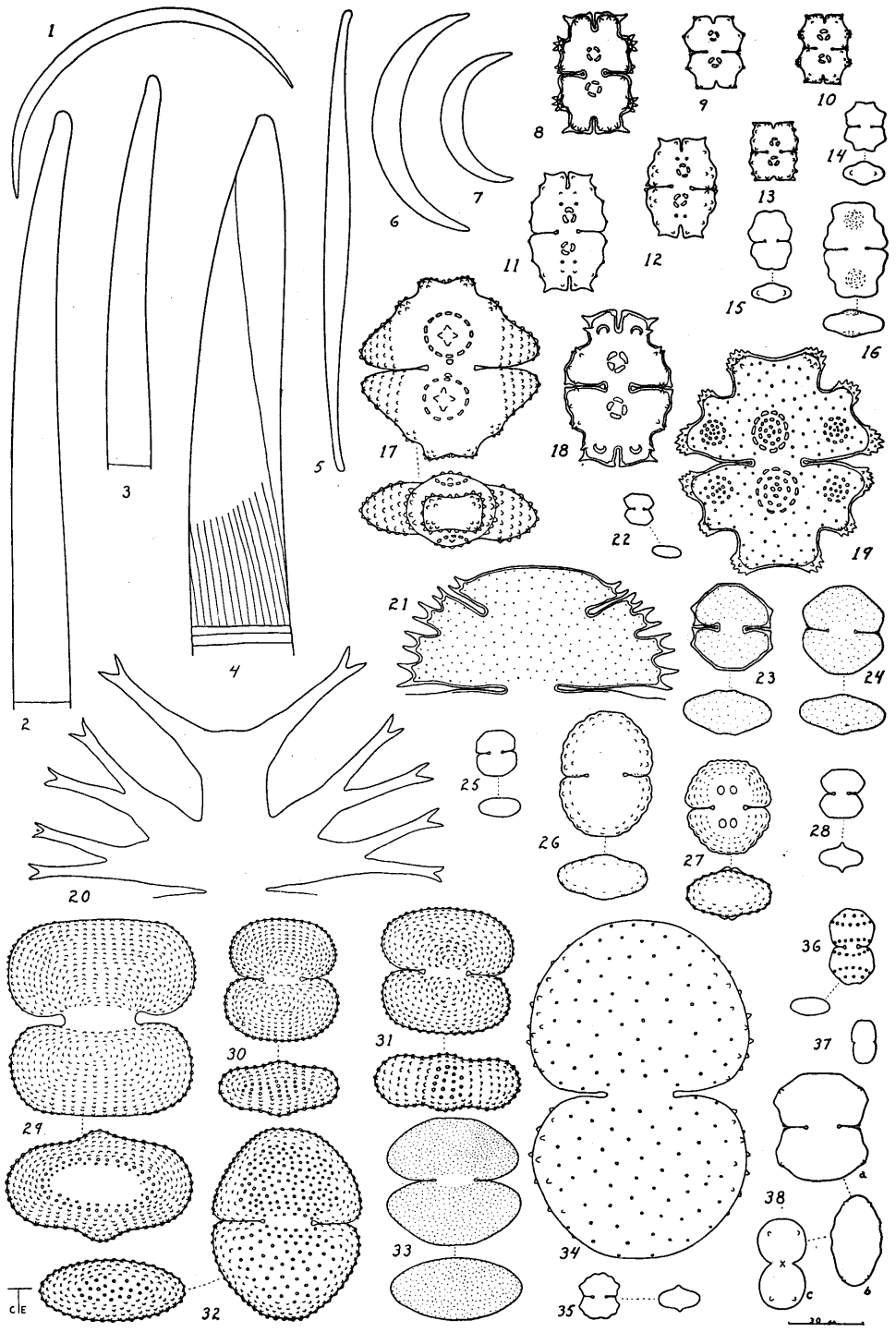
EXPLANATION OF PLATE II

Fig. 1. *Closterium parvulum* var. *angustum*. Fig. 2. *Closterium praelongum*. Fig. 3. *Closterium praelongum* var. *brevius?* Fig. 4. *Closterium pritchardianum*. Fig. 5. *Closterium subulatum*. Fig. 6. *Closterium venus*. Fig. 7. *Closterium venus* var. *incurvum*. Fig. 8. *Euastrum abruptum*. Fig. 9. *Euastrum abruptum* var. *lagöense*. Fig. 10. *Euastrum abruptum* var. *lagöense forma?* Figs. 11, 12. *Euastrum bidentatum*. Two cells with variable granulation. Fig. 13. *Euastrum dubium forma?* Fig. 14. *Euastrum binale* var. *hains*. Fig. 15. *Euastrum insulare* var. *silesiacum?* Fig. 16. *Euastrum lutkemulleri*. Fig. 17. *Euastrum ohioense*, n. sp. Fig. 18. *Euastrum quebecense*. Fig. 19. *Euastrum verrucosum* var. *alatum*. Fig. 20. *Micrasterias radiata*. Fig. 21. *Micrasterias truncata*. Near the var. *semiradata*. Fig. 22. *Cosmarium abbreviatum*. Fig. 23. *Cosmarium angulare*. Fig. 24. *Cosmarium angulare* var. *canadense*. Fig. 25. *Cosmarium angulosum*. Fig. 26. *Cosmarium aphanichondrum*. Fig. 27. *Cosmarium bipunctatum*. Fig. 28. *Cosmarium bireme*. Fig. 29. *Cosmarium biretum*. Fig. 30. *Cosmarium biretum* var. *minus*. Fig. 31. *Cosmarium biretum* var. *trigibberum*. Fig. 32. *Cosmarium botrytis*. Fig. 33. *Cosmarium depressum* var. *achondrum*. Fig. 34. *Cosmarium dentatum*. Fig. 35. *Cosmarium crenulatum* var. *tumidulum*. Fig. 36. *Cosmarium difficile* var. *sublaeve*. Fig. 37. *Cosmarium exiguum?* Fig. 38a, b, c. *Cosmarium eriense*, n. sp. 38a, face view of cell; 38b, end view; 38c, side view.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of variable depth; vertical view elliptic with variously disposed protuberances on either side. One irregularity lobed and ridged chloroplast with one or more pyrenoids in each semicell.

1. *Euastrum abruptum* Nordst. (Pl. II, Fig. 8). L. 38–41μ, w. 27–28μ, w. polar lobe 18μ, isth. 6–7μ. East Harbor.

   There was some variability in the number and position of the granules, but in general the cells were remarkably constant.
2. *Euastrum abruptum* var. *lagöense* (Nordst.) Krieger (Pl. II, Fig. 9). L. 23–27μ, w. 18–21μ, w. polar lobe 12–14μ, isth. 4–5μ. East Harbor.

   The conical tooth on the lateral lobes of some cells was pronounced while in others it was lacking.
3. *Euastrum abruptum* var. *lagöense* (Nordst.) Krieger forma? (Pl. II, Fig. 10). L. 24μ, w. 18μ, isth. 4μ. East Harbor.

   Several cells were seen which were constant in size, and were undoubtedly variations of the variety *lagöense*. They differed by having three small granules on the margins of each lateral lobe and four pronounced granules within the apex on each side of the apical incision.
4. *Euastrum bidentatum* Naeg. (Pl. II, Figs. 11, 12). L. 32–41μ, w. 24–26μ, isth. 4–7μ. East Harbor, Pelee.

   The material, as might be expected, was quite variable. Although the general outline of the cells was fairly constant, there was a great deal of variation in the granulation, and sometimes in the granulation of the two semicells of one plant.
5. *Euastrum dubium* Naeg. forma? (Pl. II, Fig. 13). L. 19–23μ, w. 16–19μ, w. polar lobe 12–13μ, isth. 3–5μ. Haunk, East Harbor.

   The writer doubtfully includes this as a form of *Eu. dubium* Naeg. As only occasional cells were encountered, the extent of its variability has not been ascertained.
6. *Euastrum binale* (Turp.) Ehren. var. *hians* (W. West) Krieger (Pl. II, Fig. 14). L. 14–17μ, w. 11–13μ, isth. 3–4μ. Kelleys Isl.
7. *Euastrum insulare* (Wittr.) Roy var. *silesiacum?* Grönblad (Pl. II, Fig. 15). L. 19–20μ, w. 14μ, isth. 3–4μ. Pelee.

   There appears to be some question in the minds of various workers as to the exact differences between *Eu. binale* and its varieties and *Eu. insulare* and its varieties. This material has some characters referable to both, but it has been questionably placed with the latter.
8. *Euastrum lütkemulleri* Duc. (Pl. II, Fig. 16). L. 28μ, w. 21μ, isth. 7μ. Kelleys Isl.

   In outline this is almost identical to the figure given by Rich (1935) for *Eu. insulare* (Wittr.) Roy *forma*. The dimensions however are noticeably greater. Krieger (1937) includes this form in *Eu. lütkemulleri* Duc. In a very general way it may resemble this species in size and outline, but the wall characters seem to be entirely different. While Rich gives no clue as to the wall character or the shape of the vertical view beyond saying that it belongs to *Eu. insulare*, the Lake Erie material definitely does not have the wall structure of *Eu. lütkemulleri*. The writer believes that the Lake Erie and South African material is comparable and that it should be given specific rank. Until additional material is available for study, it will be referred to *Eu. lütkmulleri* Duc.
9. **Euastrum ohioense** Taft n. sp. (Pl. II, Fig. 17). Cells of medium size, as broad as long, dimensions extremely constant, deeply constricted, sinus closed, then opening outwards; semicells broadly pyramidate; polar lobe with a broad cuneate depression, each angle furnished with small, conical teeth, about four showing on the face within each angle; lateral margins slightly concave, each with a slight protuberance immediately below the polar lobe, each protuberance showing three conical teeth along the margin and three within the margin; basal lobes sharply rounded, each with about five vertical rows of conical granules; the center of each semicell furnished with four conical granules surrounded by a ring of flattened, rectangular granules and one conspicuous granule immediately above the isthmus; vertical view with a median tumid area showing three conical granules and a portion of the ring of granules, ends with about five rows of conical granules. L. 60μ, w. 60μ, w. polar lobe 23μ, isth. 16μ. East Harbor.

Cellulae mediocres, tam latae quam longae, mensuris constantissimis, alte constrictae, sinu clauso, deinde extra se pandente; semicellulae late pyramidatae; lobulo polare late et cuneate depresso, omni angulo dentibus parvis conicisque ornatis, circa quattuor in superficie in omni angulo aspectabilibus; margines laterales aliquantum concavi, quoque proxime infra lobulum polarem protuberationem parvem praebente, omni protuberatione tres dentes conicos secundum marginem et tres in margine praebente; lobuli basales acute rotundi, quoque circa quinque ordines rectos granulorum conicicorum praebente; centro omnis semicellulae quattuor granulis conicis orbe granulorum complanatorum orthogoniorumque et uno granulo conspicuo proxime super isthmum circumclusis ornato; a vertice aspectus, area tumida media tria granula conica et partem orbis granulorum praebente, in circa quinque ordines granulorum conicorum desinit. Long. 60μ, lat. 60μ, lat. isth. 16μ.

This desmid, with slight variations, has appeared in the writer's collections from Oklahoma and from fossil material in Ohio as well as from the Lake Erie Region. While the cell outline is constant the granulation appears to be somewhat variable in the specimens from the different localities. It should be compared with *Eu. hypochondrum* Nordst. from which it differs by having a depressed polar lobe, more sharply rounded basal angles, slightly different granulation of the polar lobe, and different dimensions.

10. *Euastrum quebecense* Irenee-Marie (Pl. II, Fig. 18). L. 55μ, w. 37μ, w. polar lobe 23μ, isth. 6μ. Pelee.
11. *Euastrum verrucosum* Ehren. var. *alatum* Wolle (Pl. II, Fig. 19). L. 76–80μ, w. 62–67μ, w. polar lobe 30–35μ, isth. 16–18μ. Kelleys Isl., Pelee.

Micrasterias Ag. 1827

Cells variable in size, greatly compressed, with a very deep, nearly linear, median incision; semicells usually five lobed; apical lobe widely cuneate; lateral lobes bilobulate; face of semicell without granulate protuberances; one lobed chloroplast with many pyrenoids in each semicell.

1. *Micrasterias radiata* Hass. (Pl. II, Fig. 20). L. 140μ, w. 106μ, w. of polar lobe 89μ, isth. 18μ. East Harbor.
2. *Micrasterias truncata* (Corda) Bréb. near the var. *semiradiata* Cleve (Pl. II, Fig. 21). L. 80–88μ, w. including teeth 92–96μ, w. without teeth 83μ, isth. 11–13μ. East Harbor.

Members of the genus *Micrasterias* are rare in the Island Region of Lake Erie. As yet there are no verified records of the occurrence of a single species on the Islands. The two species reported are from the mainland, and one of these two, *M. truncata* var. ? is the only one that may be reported as abundant.

Cosmarium Corda 1834

Cells extremely variable in size, usually somewhat longer than broad, more or less compressed, usually with a fairly deep median constriction; cells variable in outline, without radiating processes or spines; vertical view usually oblong or elliptic, often with a central protuberance; chloroplasts usually axial, with one or two pyrenoids; cell wall varying from smooth to papillate, markings usually forming a definite pattern.

1. *Cosmarium abbreviatum* Racib. (Pl. II, Fig. 22). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 10–11μ, w. 9–10μ, isth. 2–3μ. Squaw Harbor.

The dimensions of these individuals were intermediate between *Cos. abbreviatum* Racib. and the forma *minor* W. & G. S. West. They have been referred to the species with the feeling that forma *minor* represents the minimum size range of the species.

2. *Cosmarium angulare* Johnson (Pl. II, Fig. 23). Cell wall indistinctly punctulate; chloroplasts axial, with one pyrenoid. L. 28–30μ, w. 25–27μ, isth. 6–8μ. Kelleys Isl., Fisher.
3. *Cosmarium angulare* var. *canadense* Irenee-Marie (Pl. II, Fig. 24). Cell wall indistinctly punctulate; chloroplasts axial, with one pyrenoid. L. 28–29μ, w. 26–27μ, isth. 7–8μ. Fisher, Wehrle, Pelee.

Irenee-Marie (1938) states in his description that this variety is distinguished from the species "*par l'absence de protubérance au milieu des hémisomates*, de sorte que la vue apicale est parfaitment elliptique." In the Lake Erie material which was associated

with the species, the vertical view showed a slight tumid condition. In other respects it resembles the specimens described by Irenee-Marie.

4. *Cosmarium angulosum* Bréb. (Pl. II, Fig. 25). Cell wall smooth, chloroplasts axial, with one pyrenoid. L. 16μ, w. 14μ, isth. 3–4μ. Squaw Harbor.
5. *Cosmarium aphanichondrum* Nordst. (Pl. II, Fig. 26). Chloroplasts axial, with one pyrenoid. L. 39–40μ, w. 32μ, isth. 9μ. Squaw Harbor, Beach pools, Middle Bass.
6. *Cosmarium bipunctatum* Borg. (Pl. II, Fig. 27). Chloroplasts axial, with one pyrenoid. L. 27–31μ, w. 25–30μ, isth. 8μ. Squaw Harbor.
7. *Cosmarium bireme* Nordst. (Pl. II, Fig. 28). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 16–17μ, w. 14–15μ, isth. 3–4μ. Squaw Harbor, East Harbor.
8. *Cosmarium biretum* Bréb. (Pl. II, Fig. 29). Chloroplasts axial, with two pyrenoids. L. 64–65μ, w. 60–64μ, isth. 21–23μ. Smith, Dock on North Bass.

   Nearly all the specimens exhibited the open sinus, a peculiar character for this species.
9. *Cosmarium biretum* var. *minus* Hansg. (Pl. II, Fig. 30). L. 39–41μ, w. 36–38μ, isth. 11–12μ. Middle Isle.

   The upper angles are rounded more than usual in this variety.
10. *Cosmarium biretum* var. *trigibberum* Nordst. (Pl. II, Fig. 31). L. 43μ, w. 43μ, isth. 14μ. Haunk, Squaw Harbor, Middle Bass.
11. *Cosmarium botrytis* Menegh. (Pl. II, Fig. 32). Chloroplasts axial with two pyrenoids. L. 60–66μ, w. 50–53μ, isth. 16–18μ. Pelee.

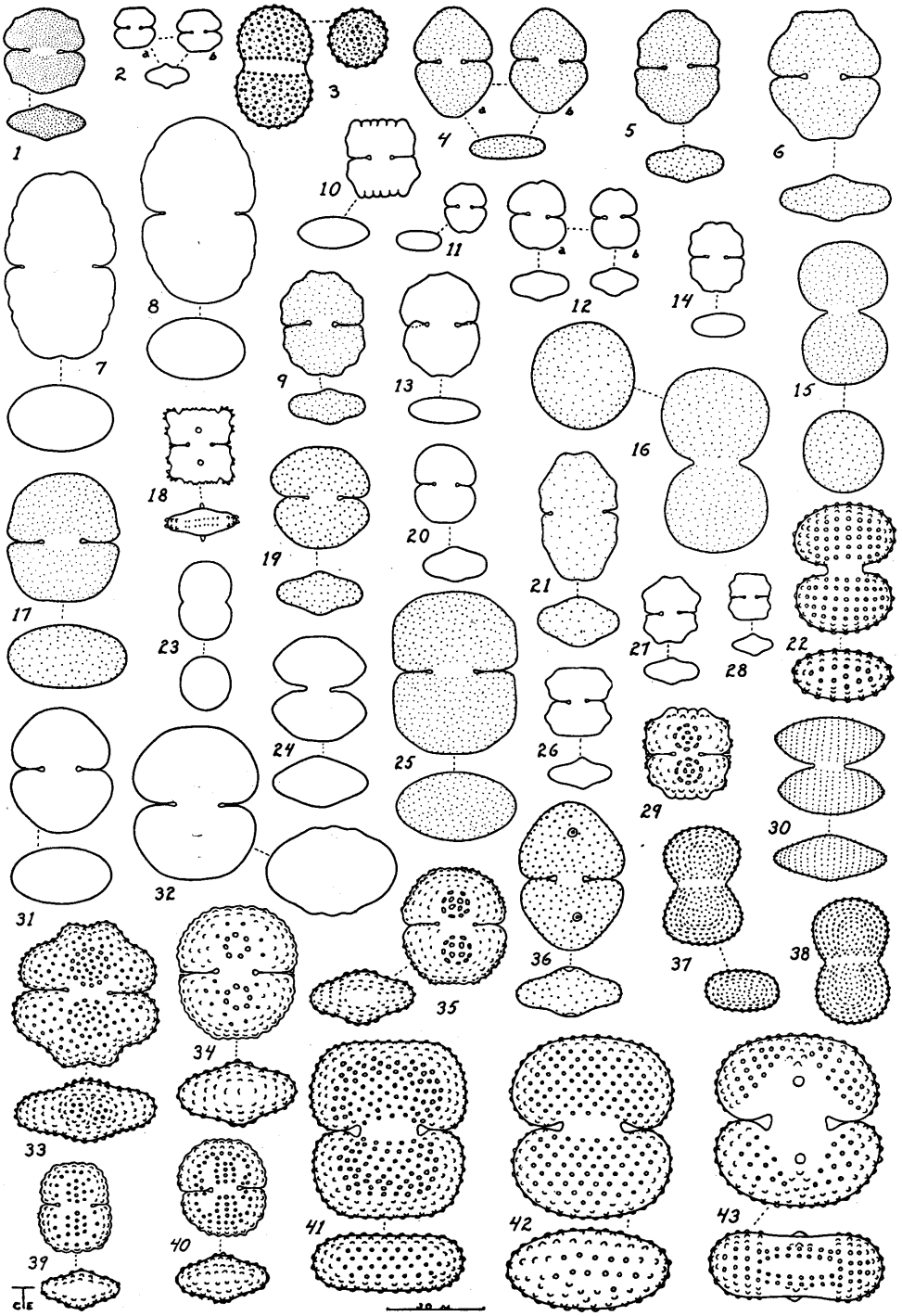
    This species was reported as being widely distributed in the Island Region by Pieters (1901) and Snow (1902). This has not been the case in the present survey where the writer has collected it only on Pelee Island.
12. *Cosmarium crenulatum* var. *tumidulum* Insam & Krieger (Pl. II, Fig. 35). Chloroplasts axial, with one pyrenoid. L. 15μ, w. 13μ, isth. 3–4μ. Exact locality unknown.

    Insam & Krieger (1936) give the dimensions of their specimens as 20.5 x 15.6 x 4.3μ. These are slightly larger than the dimensions of the present material. It should be compared to *Cos. perpusillum* West from which it differs by having more rounded apices instead of being retuse-truncate, and by its tumid vertical view.
13. *Cosmarium dentatum* Wolle (Pl. II, Fig. 34). Chloroplasts numerous, parietal, each with numerous pyrenoids. L. 115–142μ, w. 74–87μ, isth. 25–28μ. East Harbor.

    This is an extremely large species and exhibits more or less variation, especially in the number and prominance of the marginal teeth.
14. *Cosmarium depressum* (Naeg.) Lund. var. *achondrum* (Boldt) W. & G. S. West (Pl. II, Fig. 33). Cell wall finely punctulate; chloroplasts axial, with one pyrenoid. L. 33–43μ, w. 43–46μ, isth. 10–11μ. Wehrle.

EXPLANATION OF PLATE III

Fig. 1. *Cosmarium fontigenum*. Fig. 2. *Cosmarium geometricum* var. *suecicum*. 2a and 2b show slight variations in cell shape. Fig. 3. *Cosmarium globosum* var. *subaltum*. Fig. 4. *Cosmarium granatum*. 4a and 4b show slight variations in cell shape. Fig. 5. *Cosmarium granatum* var. *subgranatum*. Fig. 6. *Cosmarium hammeri* var. *protuberans*. Fig. 7. *Cosmarium holmiense*. Fig. 8. *Cosmarium holmiense forma?* Fig. 9. *Cosmarium impressulum* var. *suborthogona*. n. comb. Fig. 10. *Cosmarium humile* var. *striatum*. Fig. 11. *Cosmarium laeve*. Fig. 12. *Cosmarium laeve* var. *distentum forma?* 12a and 12b showing variations in size and shape. Fig. 13. *Cosmarium laeve* var. *octangulare*. Fig. 14. *Cosmarium meneghinii*. Fig. 15. *Cosmarium moniliforme* var. *punctata*. Fig. 16. *Cosmarium moniliforme* var. *subpyriforme*. Fig. 17. *Cosmarium nitidulum* var. *pseudovalidum* n. var. Fig. 18. *Cosmarium nobile*. Fig. 19. *Cosmarium phaseolus* var. *elevatum*. Fig. 20. *Cosmarium phaseolus forma minor?* Fig. 21. *Cosmarium pokornyanum*. Fig. 22. *Cosmarium portianum*. Fig. 23. *Cosmarium pseudarctoum*. Fig. 24. *Cosmarium pseudoprotuberans*. Fig. 25. *Cosmarium rectangulare*. Figs. 26, 27. *Cosmarium regnelli*. The two figures show extreme variations which may occur. Fig. 28. *Cosmarium regnelli* var. *minimum*. Fig. 29. *Cosmarium seelyanum*. Fig. 30. *Cosmarium subraciborskii* n. sp. Fig. 31. *Cosmarium subtumidum* var. *klebsii*. Fig. 32. *Cosmarium sulcatum* var. *sumatranum*. Fig. 33. *Cosmarium protractum*. Fig. 34. *Cosmarium punctulatum* var. *subpunctulatum*. Fig. 35. *Cosmarium subcostatum?* Fig. 36. *Cosmarium variolatum* var. *cataractarum*. Figs. 37, 38. *Cosmarium viride* var. *compressum* n. var. Two cells which vary in shape are figured. Fig. 39. *Cosmarium subcrenatum*. Fig. 40. *Cosmarium subcrenatum forma?* Fig. 41. *Cosmarium quadrum* var. *minus*. Fig. 42. *Cosmarium reniforme*. Fig. 43. *Cosmarium reniforme* var. *seminudum* var. nov.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15. *Cosmarium difficile* (Lutk.) var. *sublaeve* Schroeder (Pl. II, Fig. 36). Chloroplasts axial, with one pyrenoid. L. 21–26μ, w. 12–14μ, isth. 2–3μ. Kelleys Isl.

The Lake Erie material compares favorably with the figure of the variety given by Skuja (1928). Although he does not give the exact dimensions of the cells it would appear from the magnification that they are nearly the same. Dimensions of Michigan material reported by Prescott and Magnotta (1935) are somewhat greater.

16. **Cosmarium eriense** Taft n. sp. (Pl. II, Fig. 38). Cells of medium size, slightly longer than broad, deeply constricted, sinus linear, closed; semicells somewhat rectangular, each with a broad truncate lobe just below the apical angles, each lobe with a conical granule within the margin of the upper angle, apex truncate, upper lateral margins slightly retuse, basal angles broadly rounded, each furnished with a single medianly placed granule; vertical view ellipsoid with broadly rounded ends, each side with three undulations, four granules visible, one on either side near the ends. Cell wall indistinctly punctate. Chloroplasts single, axial, with one pyrenoid. L. 35–37μ, w. 30–33μ, isth. 11μ. Pelee.

Cellulae mediocres, paulo longiores quam latae, alte constrictae, sinu lineare clausoque; semicellulae eliquantum orthogoniae, quoque lobulum latum truncatum proxime infra angulos apicales praebente, omni lobulo granulum conicum in margine anguli superioris praebente, apex truncatus, margines laterales superiores aliquantum retusi, anguli basales late rotundati, quoque uno granulo, in medio locato, ornato; a vertice visae ellipticae, extremis late rotundatus, omni latere 3-undulato, quattiorgranuli aspectabiles, unus in utroque latere ad extrema. Nurus cellulae obscure punctatus. Chlorophyllaceae singulae, axiales, unum pyrenoidum praebentes. Long. 35–37μ, lat. 30–33μ, lat. isth. 11μ.

17. *Cosmarium exiguum* ? Arch. (Pl. II, Fig. 37). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 14–15μ, w. 7–8μ, isth. 6–7μ. Kelleys Isl.

18. *Cosmarium favum* West (Pl. IV, Fig. 1). Chloroplasts axial, with one pyrenoid. L. 62μ, w. 51μ, isth. 15μ. Kelleys Isl.

The lines delimiting the hexagonal areas are extremely delicate and may only be seen after critical lighting and focusing.

19. *Cosmarium fontigenum* Nordst. (Pl. III, Fig. 1). Cell wall finely punctulate; chloroplasts axial, with one pyrenoid. L. 22μ, w. 20–21μ, isth. 5–6μ. East Harbor.

It is almost a certainty that the writer passed over this small species in some of the earlier collections. Because of the curvature of the cells, the peculiar undulate character of the lateral margins is not readily evident when examining specimens, although the undulations are quite apparent in camera lucida figures.

20. *Cosmarium formulosum* Hof. (Pl. IV, Fig. 2). Chloroplasts axial, with two pyrenoids. L. 35–50μ, w. 32–42μ, isth. 9–13μ. Wehrle, Squaw Harbor.

21. *Cosmarium formulosum* forma? (Pl. IV, Fig. 3). L. 48–55μ, w. 44–48μ, isth. 11–13μ. Middle Isl.

Although the dimensions of this form intergrade with those of the species, the majority of the specimens are definitely larger. Otherwise the cells are similar.

22. **Cosmarium franzstonii** Taft n. sp. (Pl. IV, Fig. 4). Cells large, about one-fifth longer than broad, deeply constricted, sinus linear, closed; semicells ovate-pyramidate, apex slightly flattened, apical angles rounded; cell wall granulate with punctulations between the granules, granules near the apex large, becoming smaller and more numerous across the center and near the base of the semicell, center of semicell with two large protuberances which are evident because of their granulation; vertical view broadly elliptical with two large protuberances on either side, granules extending down to the protuberances larger than those in the center or at either end. Two massive chloroplasts in each semicell, each with one pyrenoid. L. 60–65μ, w. 50–55μ, isth. 16–20μ, thick 32μ. Gibraltar, Squaw Harbor, Middle Bass, Haunk, Kelleys Isl.

Cellulae magnae circa one-fifth longiores quam latae, late constrictae, sinu lineare clausoque; semicellulae ovato-pyramidatae, apex aliquantum complanatus, anguli apicales rotundati; murus cellulae granulatus, punctulationes inter granula habens, granula ad apicem magna, paullatim minores frequentioresque trans centrum et ad basam semicellulae. In centro semicellulae duae protuberationes magnae evidentes propter granu-

lationem; a vertice visae late ellipticae, duae protuberationes magnae in utroque aspectabiles, granulis in protuberationes maiores quam eae in centro aut in utroque extreme desuper patentibus. Duae chlorophyllaceae magnissimae in utraque semicellula, quaque unum pyrenoidum habente. Long. 60–65μ, lat. 50–55μ, lat. isth. 16–20μ.

The form of the semicells, the granulation, and the widely separated central protuberances separate it from *Cos. turpinii* and *Cos. didymoprotupsum.*

23. *Cosmarium geometricum* W. & G. S. West var. *suecicum* Borge (Pl. III, Fig. 2). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 12μ, w. 11μ, isth. 3μ. Kelleys Isl.

24. *Cosmarium globosum* Bulh. var. *subaltum* Messikommer (Pl. III, Fig. 3). Cell wall finely granulate; chloroplasts axial, with one pyrenoid. L. 35μ, w. 20μ, isth. 16μ Kelleys Isl.

This form was rarely found in the collections. It should be compared to *Cos. globosum* var. *granulatum* Schmidle and also with *Cos. trachypolum* West var. *aequaliter-granulata* Lutk. which has punctae between the granules.

25. *Cosmarium granatum* Bréb. (Pl. III, Fig. 4). Cell wall finely granulate; chloroplasts axial, with one pyrenoid. L. 23–27μ, w. 18–19μ, isth. 4–5μ. Haunk, Fisher, Smith, Squaw Harbor, Kelleys Isl., Pelee.

This highly variable species is widely distributed over the region. The lateral margins vary from strongly convex to strongly retuse, the latter condition being exemplified best by the individuals from Squaw Harbor. These might well be placed in the variety *concavum* Lagerh. which is considered as a local variation by some workers.

26. *Cosmarium granatum* var. *subgranatum* Nordst. (Pl. III, Fig. 5). Cell wall finely granulate, chloroplasts axial, with one pyrenoid. L. 25–29μ, w. 18–21u, isth. 4–5μ. Haunk, Fisher, Wehrle, Pelee.

27. *Cosmarium hammeri* Reinsch var. *protuberans* W. & G. S. West (Pl. III, Fig. 6). Cell wall finely punctate; chloroplasts axial, with one pyrenoid. L. 32–35μ, w. 25–29μ, isth. 8–10μ. Pelee.

28. *Cosmarium holmiense* Lund. (Pl. III, Fig. 7). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 50μ, w. 30μ, isth. 16μ. Kelleys Isl.

29. *Cosmarium holmiense* Lund. forma? (Pl. III, Fig. 8). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 48–50μ, w. 28–30μ, isth. 16μ. Kelleys Isl.

The dimensions and cell outline are almost exactly those of *Cos. holmiense* var. *trigonum* Nordst. The vertical view, however, is oval instead of triangular.

30. *Cosmarium impressulum* var. **suborthogona** (W. & G. S. West) Taft, new comb. (Pl. III, Fig. 9).

(*Cosmarium suborthogona* Racib., Desm. Nowe, 1889, p. 85, t. 5, fig. 29.)

(*Cosmarium impressulum* forma *suborthogona* W. & G. S. West, British Desmidiaceae, 1908, Vol. 3, p. 88.)

Cells rather small, nearly 1½ times as long as broad, constriction deep, closed, with a dilated apex; semicells subsemicircular, margin regularly eight-undulate, including basal angles, undulations equal, two at the apex and two on each side; vertical view elliptic, with a slight protuberance on each side near the middle; cell wall very finely punctulate; chloroplasts axial, with one pyrenoid. L. 25–27μ, w. 19–21μ, isth. 4–6μ. Haunk.

This desmid was first described by Raciborski as *Cos. suborthogona* and differed from *Cos. impressulum* only in the presence of the protuberances in vertical view. The Wests (1908) considered this to be an insufficient specific character, so placed it as *forma suborthogona* of *Cos. impressulum.* As the character appears to be constant, and as individuals have now appeared in widely separated areas, the writer gives it varietal rank.

31. *Cosmarium humile* (Gay) Nordst. var. *striatum* (Boldt) Schmidle (Pl. III, Fig. 10). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 16–19μ, w. 16–19μ, isth. 4μ. Wehrle, Haunk, Fisher, Smith, Squaw Harbor.

32. *Cosmarium kjellmani* Wille var. *grande* Wille (Pl. IV, Fig. 5). Chloroplasts axial, with two pyrenoids. L. 46–50μ, w. 37–39μ, isth. 11–13μ. Squaw Harbor, Dock at N. Bass.

33. *Cosmarium laeve* Raben. (Pl. III, Fig. 11). Cell wall appearing smooth, usually sparsely punctate, colorless; chloroplasts axial, with one pyrenoid. L. 13–14μ, w. 11–12μ, isth. 2–3μ. Squaw Harbor, East Harbor.

34. *Cosmarium laeve* var. *distentum* G. S. West forma? (Pl. III, Fig. 12). Chloroplasts axial, with one pyrenoid. L. 14–18μ, w. 11–15μ, isth. 3–4μ. Kelleys Isl., Beach pools on Middle Bass.

The cell outline is distinctly that of *Cos. laeve* but the vertical view is tumid. The specimens were somewhat smaller than those described by West, otherwise they were similar.

35. *Cosmarium laeve* var. *octangulare* (Wille) W. & G. S. West (Pl. III, Fig. 13). L. 26μ, w. 18μ, isth. 7μ. Pelee.

36. *Cosmarium lundellii* Delp. var. *ellipticum* West (Pl. IV, Fig. 6). Cell wall with small sparse granules; chloroplasts axial, ridged, with two pyrenoids. L. 69–87μ, w. 50–57μ, isth. 14–16μ. Fisher.

Although smaller, these cells slightly resemble *Cos. ochthodes* var. *aequalis* Insam & Krieger.

37. *Cosmarium margaritatum* (Lund.) Roy & Biss. (Pl. IV, Fig. 7). Chloroplasts axial, with two pyrenoids. L. 57–60μ, w. 46–48μ, isth. 18μ. Wehrle.

38. *Cosmarium meneghinii* Bréb. (Pl. III, Fig. 14). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 17–18μ, w. 11–14μ, isth. 3.5μ. Squaw Harbor, Beach pools on Middle Bass.

39. *Cosmarium moniliforme* (Turp.) Ralfs var. *punctata* Lagerh. (Pl. III, Fig. 15). Cell wall finely punctulate; chloroplasts axial, with about 6–7 radiating plates, one pyrenoid. L. 37–41μ, w. 23μ, isth. 7μ. East Harbor.

40. *Cosmarium moniliforme* var. *subpyriforme* W. & G. S. West (Pl. III, Fig. 16). Cell wall finely punctulate; chloroplasts with 10–11 flanges, one pyrenoid. L. 44–48μ, w. 25–28μ, isth. 11–12μ. Pelee.

In the original description of this variety only one set of dimensions is given. Unless the Wests' material was extremely constant, they saw only one specimen. While the dimensions of the Lake Erie material are distinctly greater, the writer feels that they possibly exhibit the upper limits of the size range. Material from Arkansas, collected by Couch (unpublished) is decidedly smaller, the dimensions being 35 x 20 x 6μ.

41. *Cosmarium nitidulum* De Not. var. **pseudovalidum** Taft n. var. (Pl. III, Fig. 17). Cells slightly longer than broad, deeply constricted, sinus linear; semicells subrectangular, basal angles nearly rectangular, more or less produced, upper angles broadly rounded, apex truncate-convex. Vertical view elliptic. Cell wall punctate. Chloroplasts axial, with one pyrenoid. L. 33–35μ, w. 28–30μ, isth. 6–7μ. Kelleys Isl.

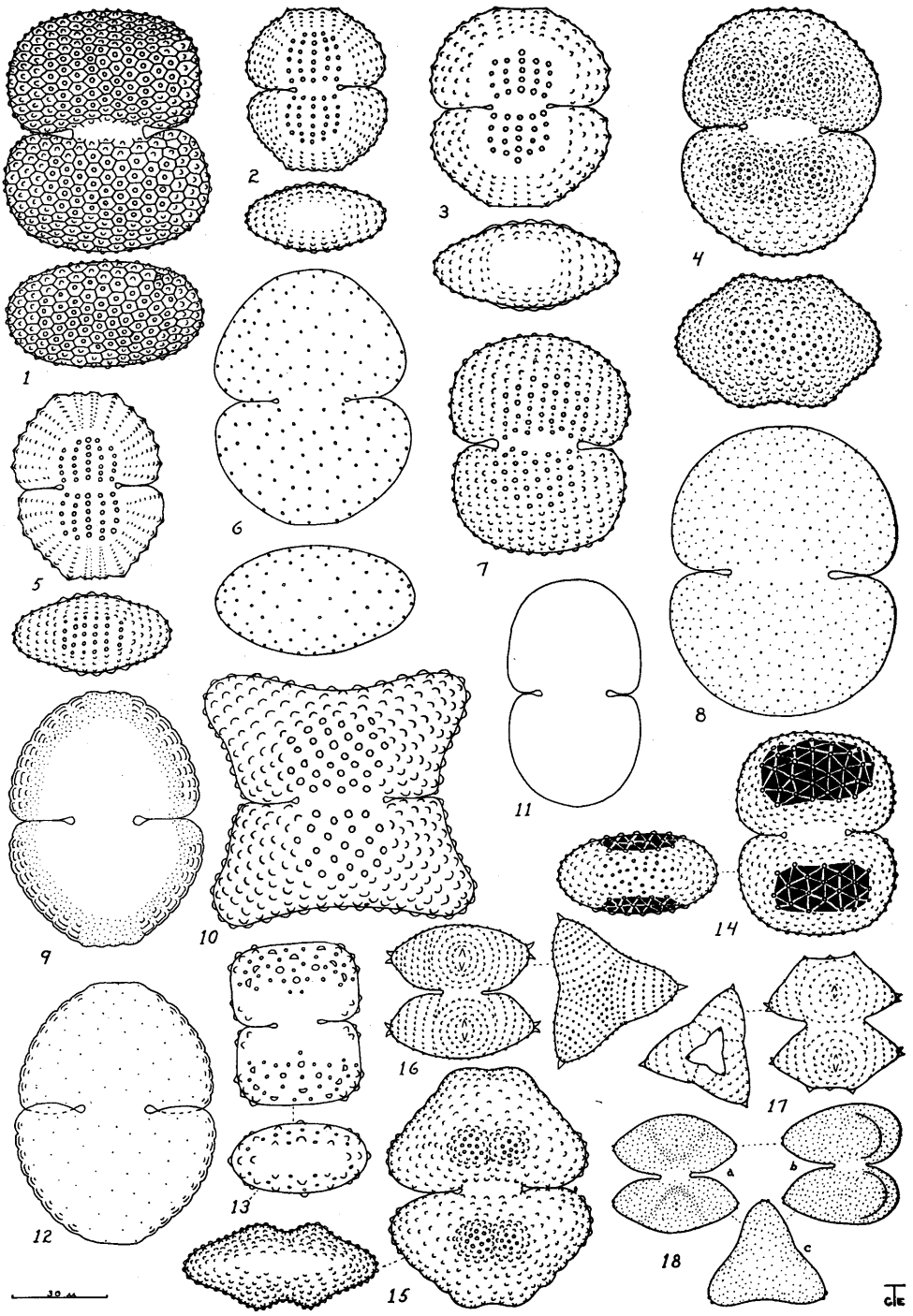
C. medio sinu lineare profundo constrictum; semicellulis transverse subrectangularis, diametro maximo paullo supramedio, angulis inferioribus obtusis rotundatis, angulis superioribus late rotundatis, apicibus truncatis vel convexis; cellulis a vertice ellipticis. Membrana distincte punctata. Pyrenoides singuli. Long. 33–35μ, lat. 28–30μ; lat. isth. 6–7μ.

This variety is separated from *Cos. nitidulum* because of the rectangular or produced basal angles. In this respect it resembles *Cos. pseudonitidulum* var. *validum*. It differs from this variety by its smaller dimensions and the presence of only one pyrenoid in each chloroplast, the latter being a distinctive character of *Cos. nitidulum*.

42. *Cosmarium nobile* (Turner) Krieger (Pl. III, Fig. 18). This species was incompletely described as a species of *Euastrum* by Turner (1892) from notes left by Dr. Wallich.

EXPLANATION OF PLATE IV

Fig. 1. *Cosmarium favum*. Fig. 2. *Cosmarium formulosum*. Fig. 3. *Cosmarium formulosum forma?* Fig. 4. *Cosmarium franzstonii* n. sp. Fig. 5. *Cosmarium kjellmani* var. *grande*. Fig. 6. *Cosmarium lundellii* var. *ellipticum*. Fig. 7. *Cosmarium margaritatum*. Fig. 8. *Cosmarium pachydermum* var. *aethiopicum*. Fig. 9. *Cosmarium ochtodes*. Fig. 10. *Cosmarium porrectum*. Fig. 11. *Cosmarium subcucumis*. Fig. 12. *Cosmarium subochthodes*. Fig. 13. *Cosmarium triplicatum*. Fig. 14. *Cosmarium subnudiceps* var. *granulatum* n. var. Fig. 15. *Cosmarium turpinii* var. *podolicum*. Fig. 16. *Staurastrum avicula* var. *subarcuatum*. Fig. 17. *Staurastrum biarcuus* n. sp. Fig. 18a, b, c. *Staurastrum bieneanum*. Figs. 18a and b are face views of the cell from different angles; 18c is the end view.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30 μ

Krieger (1937) has referred it to the genus *Cosmarium*. In the original description Turner states, "A vertice et a latere non cl. Wallichio observatum" and "Judging from the drawing it appears to have one amylum-corpuscle (large) in each semicell."

The vertical view as figured by the writer, is elliptic with slight tumid areas on either side, each having a distinct conical granule. This granule is also evident in face view and may be the "One amylum-corpuscle" referred to in Turner's description, although it is much smaller than the structure shown in his figure. If his statement "one amylum-corpuscle" does refer to the pyrenoid, then there is some discrepancy as the present material shows two pyrenoids. L. 17–18μ, w. 17–18μ, isth. 4μ. Haunk.

43. *Cosmarium ochtodes* Nordst. (Pl. IV, Fig. 9). Cell wall punctate within the marginal crenations; chloroplasts axial, with two pyrenoids. L. 67–74μ, w. 50–55μ, isth. 14–16μ. Pelee, Kelleys Isl.
44. *Cosmarium pachydermum* Lund var. *aethiopicum* W. & G. S. West (Pl. IV, Fig. 8). Cell wall punctate, punctae interspersed with very fine punctulations; chloroplasts axial, with two pyrenoids. L. 78–83μ, w. 62μ, isth. 27–30μ. Pelee.
45. *Cosmarium phaseolus* Bréb. var. *elevatum* Nordst. (Pl. III, Fig. 19). Cell wall smooth, colorless; chloroplasts axial, with one pyrenoid. L. 23–25μ, w. 21–23μ, isth. 4–5μ. East Harbor, Squaw Harbor, Haunk, Wehrle.
46. *Cosmarium phaseolus* forma *minor?* Boldt. (Pl. III, Fig. 20). Cell wall smooth, colorless; chloroplasts axial, with one pyrenoid. L. 17–20μ, w. 16μ, isth. 4μ. Fisher, Pelee.

The shape of the semicells of this form is almost exactly that of *Cos. phaseolus* var. *rectangulare* Insam & Krieger (1936) but the dimensions are about half those of this variety. In size and cell outline it is very near forma *minor* Boldt as figured by Skuja (1928) and Irenee-Marie (1938).

47. *Cosmarium pokornyanum* (Grun.) W. & G. S. West (Pl. III, Fig. 21). Cell wall sparsely punctate; chloroplasts axial, with one pyrenoid. L. 33–35μ, w. 18–19μ, isth. 10–11μ. Kelleys Isl.

This species should be compared with *Cos. laeve* var. *septentrionale* Wille from which it differs by having a rhomboid-ovoid vertical view and a shallow sinus.

48. *Cosmarium porrectum* Nordst. (Pl. IV, Fig. 10). Cell wall with minute pores between the granules; chloroplasts axial, each with one pyrenoid. L. max. 64–73μ, l. min. 57–62μ, w. max. 69–83μ, w. min. 51–57μ, isth. 21–23μ. East Harbor.
49. *Cosmarium portianum* Arch. (Pl. III, Fig. 22). Chloroplasts axial, with one pyrenoid. L. 33–37μ, w. 24–27μ, isth. 9–10μ. East Harbor.
50. *Cosmarium protractum* (Naeg.) De Bary (Pl. III, Fig. 33). Chloroplasts axial, with two pyrenoids. L. 33–46μ, w. 30–37μ, isth. 9–10μ. Haunk, East Harbor.
51. *Cosmarium pseudarctoum* Nordst. (Pl. III, Fig. 23). Cell wall smooth, colorless; chloroplasts axial, with about 4–5 radiating plates and one pyrenoid. L. 19–20μ, w. 14μ, isth. 10–11μ. Kelleys Isl.
52. *Cosmarium pseudoprotuberans* Kirchn. (Pl. III, Fig. 24). Cell wall appearing smooth, but with very fine punctulations; chloroplasts axial, with one pyrenoid. L. 25–27μ, w. 23–24μ, isth. 5–6μ. East Harbor.
53. *Cosmarium punctulatum* Bréb. var. *subpunctulatum* (Nordst.) Borges (Pl. III, Fig. 34). Chloroplasts axial, with one pyrenoid. L. 32μ, w. 30μ, isth. 7μ. Kelleys Isl.
54. *Cosmarium quadrum* Lund. var. *minus* Nordst. (Pl. III, Fig. 41). Chloroplasts axial, with two pyrenoids. L. 44μ, w. 35μ, isth. 14μ. Haunk.
55. *Cosmarium rectangulare* Grun. (Pl. III, Fig. 25). Cell wall punctate; chloroplasts axial, with one pyrenoid. L. 42–44μ, w. 34–35μ, isth. 11–12μ. Pelee.
56. *Cosmarium regnelli* Wille (Pl. III, Figs. 26, 27). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 17–18μ, w. 14–17μ, isth. 4–5μ. Smith, Wehrle, Fisher.

Figure 26 is that of *Cos. regnelli* Wille, while Figure 27 illustrates one of the more extreme variations. In all cases the Lake Erie material possessed a tumid vertical view, a condition which has not been generally reported. However the figures of this species by Insam and Krieger (1936) show the vertical view as either elliptic or tumid. Since this character is used in distinguishing varieties of other species, future studies may result in the segregation of a variety on the basis of the tumid condition.

57. *Cosmarium regnelli* var. *minimum* Eichl. et Gutw. (Pl. III, Fig. 28). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 11–14μ, w. 11–12μ, isth. 3–4μ. Wehrle.

Specimens of this variety, as in the species, were tumid in vertical view. They resemble closely the figure given by Messikommer (1935).

58. *Cosmarium reniforme* (Ralfs) Arch. (Pl. III, Fig. 42). Chloroplasts axial, with two pyrenoids. L. 48μ, w. 44μ, isth. 14μ. Haunk.

59. *Cosmarium reniforme* var. **seminudum** Taft n. var. (Pl. III, Fig. 43). Semicells granulate only in upper part, granules extending in oblique series from near the basal angles to the middle of the apex, from which a granulate area extends downward nearly to the center of the semicell which is furnished with one large conical granule, cell otherwise not granulate; vertical view oblong-rectangular with broadly rounded ends, lateral margins slightly concave with one large granule on either side, ends with six or seven rows of granules, these granulate areas being connected by two separate series of two or three rows of granules across the end of the cell, median portion of vertical view without granules. L. 46–48μ, w. 41μ, isth. 14μ. Squaw Harbor.

Semicellulae granulatae solum in parte superiore, granuli in serie obliqua de loco propter angulos basales ad medium apicem, a quo area granulata prope ad centrum semicellulae, uno granulo magno conico praeditae, desuper patet, cellula aliter non granulata; a vertice visae oblongo-orthogoniae, extremis late rotundatis, margines laterales aliquantum concavi, unum granulum magnum in utroque latere haventes, in sex aut septem ordines granulorum desinit, his granulis duabus seriebus separatis duorum aut trium ordinum granulorum trans extremum cellulae inter se conjunctis, pars media a vertice visa sine granulis. Long. 46–48μ, lat. 41μ, lat. isth. 14μ.

60. *Cosmarium seelyanum* Wolle (Pl. III, Fig. 29). Chloroplasts axial, with one pyrenoid. L. 23μ, w. 23μ, isth. 6–7μ. East Harbor.

The original figure and description of this species (Wolle, 1884) shows the upper angles of the semicells to be slightly more produced and the dimensions of the cells a little greater than in the Lake Erie material. Otherwise they are comparable.

61. *Cosmarium subcostatum?* Nordst. (Pl. III, Fig. 35). Chloroplasts axial, with one pyrenoid. L. 32μ, w. 27μ, isth. 7μ. Middle Isl.

The original figure of this species by Nordstedt (1876) shows a curved row of granules just below the granulate central protuberance. Later figures by other workers do not always show this row of granules. As the writer did not see enough of this material to determine the variations, it has been doubtfully assigned to this species.

62. *Cosmarium subcrenatum* Hantzsch (Pl. III, Fig. 39). Chloroplasts axial, with one pyrenoid. L. 23μ, w. 19μ, isth. 7μ. Kelleys Isl.

63. *Cosmarium subcrenatum* forma? (Pl. III, Fig. 40). Chloroplasts axial, with one pyrenoid. L. 21–25μ, w. 19–23μ, isth. 5–6μ. Squaw Harbor.

64. *Cosmarium subcucumis* Schmidle (Pl. IV, Fig. 11). Cell wall smooth; chloroplasts axial, with two pyrenoids. L. 55–60μ, w. 35–37μ, isth. 14–19μ. Kelleys Isl., Pelee.

65. *Cosmarium subnudiceps* West & West var. **granulatum** Taft n. var. (Pl. IV, Fig. 14). Cell wall densely granulate, granules not arranged in series. L. 50–54μ, w. 41–43μ, isth. 10–11μ. Kelleys Isl., Pelee, East Harbor.

Membrana granulata, granulis non regulariter ordinatis. Long. 50–54μ, lat. 41–43μ, isth. 10–11μ.

This variety differs from the species by having the cell wall which borders the sculptured areas covered with small granules. The dimensions are also somewhat greater.

66. *Cosmarium subochthodes* Schmidle (Pl. IV, Fig. 12). Cell wall with small granules; chloroplasts two, axial, each with one pyrenoid. L. 64μ, w. 50μ, isth. 16μ. Haunk.

67. **Cosmarium subraciborskii** Taft n. sp. (Pl. III, Fig. 30). Cells slightly broader than long, deeply constricted, sinus open; semicells transversely elliptic to nearly fusiform, lateral angles sharply rounded; cell wall minutely granulate, granules arranged in 18–20 vertical series across each semicell; vertical view narrowly elliptic with a slight median protuberance on either side, ends sharply rounded; a single chloroplast with one pyrenoid in each semicell. L. 23–27μ, w. 25–30μ, isth. 5–7μ. Squaw Harbor, Kelleys Isl., East Harbor.

C. paullo latius quam longius, profundo sinu ampliato constrictum; semicellulis transversis ellipticis vel fere fusiformis, angulis lateribus acutis rotundatis; membrana granulis (Verrucis minutis) in 18–20 series perpendiculares ordinatis. Semicellulae a vertice aspectae ellipticae medio utrimque tumidae. Massa chlorophyllacea singulae, pyrenoidae singulae. Long. 23–27μ; lat. 25–30μ, lat. isth. 5–7μ.

In general appearance this species stands near *Cos. raciborskii*. However its dimensions are only slightly more than one-half those of Lagerheim's species. The granulation is in distinct vertical series while that of *Cos. raciborskii* is described as "series oblique desussatas regulariter." Differences are also apparent in vertical view in which the Lake Erie material exhibits slight but distinct median protuberances and sharply rounded ends.

68. *Cosmarium sulcatum* Nordst. var. *sumatranum* Schmidle (Pl. III, Fig. 32). Cell wall smooth; chloroplasts axial, with one pyrenoid. L. 39μ, w. 29–32μ, isth. 9μ. Kelleys Isl.

The dimensions of the present material are somewhat greater than those given by Schmidle (1895). Otherwise the material is comparable.

69. *Cosmarium subtumidum* Nordst. var. *klebsii* (Gutw.) W. & G. S. West (Pl. III, Fig. 31). Cell wall smooth to very finely punctulate; chloroplasts axial, with one pyrenoid. L. 32μ, w. 25–28μ, isth. 7–9μ. Squaw Harbor.

70. *Cosmarium triplicatum* Wolle (Pl. IV, Fig. 13). Chloroplasts axial, with two pyrenoids. L. 44–46μ, w. 36–37μ, isth. 11–12μ. East Harbor, Kelleys Isl.

The original figure of this species by Wolle (1884) left much to the imagination concerning the central granulation. It was not until West (1898) had examined and figured numerous specimens from various parts of the United States that the true nature of the cell wall was recognized.

71. *Cosmarium turpinii* Bréb. var. *podolicum* Gutw. (Pl. IV, Fig. 15). Chloroplasts axial, with two pyrenoids. L. 57–64μ, w. 50–53μ, isth. 12–14μ. Wehrle, Fox, Fisher, Pelee.

This variety is rather widely distributed in the Island Region. The specimens from Pelee Island had a flat granulate apex and very slight double tumers.

72. *Cosmarium variolatum* Lund. var. *cataractarum* Racib. (Pl. III, Fig. 36). Chloroplasts axial, with one pyrenoid. L. 37–43μ, w. 25–30μ, isth. 6–7μ. Fisher, Wehrle, Squaw Harbor, Gibraltar, Kelleys Isl.

The lateral margins of the semicells vary from convex to retuse, although usually straight or convex. It should be compared to *Cos. granatum* var. *oscellatum* G. S. West which is not tumid in vertical view.

73. *Cosmarium viride* (Corda) Josh. var. **compressum** Taft n. var. (Pl. III, Figs. 37, 38). Cells rather small, slightly constricted, sinus obtuse; semicells obovate-circular with slightly depressed apices. Vertical view compressed circular. Cell wall finely but distinctly granulate, granules arranged in concentric rows within the margins of the semicells. Chloroplasts axial, with one pyrenoid. L. 30–32μ, w. 18–22μ, isth. 12–14μ. Kelleys Isl.

Semicellulis depressis obovatis-circularis; a vertice aspectis compressis circularis. Membrana granulis minutis, in series concentricas dispositis praedita. Long. 30–32μ; lat. 18–22μ; lat. isth. 12–14μ.

Because of an inadequate description, the identity of *Colopelta viridis* Corda remains

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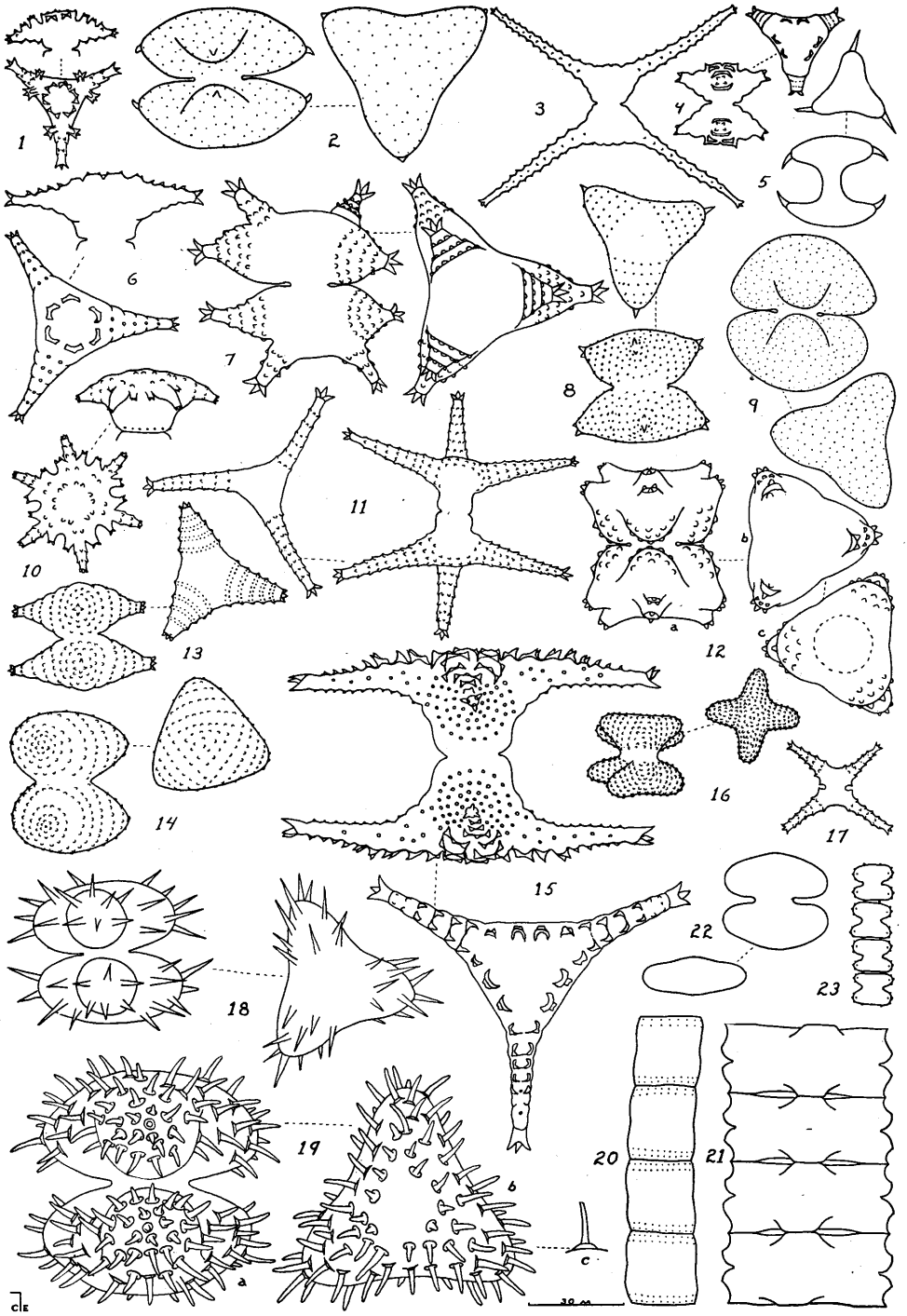
EXPLANATION OF PLATE V

Fig. 1. *Staurastrum bicoronatum* var. *tridentatum* n. var. Fig. 2. *Staurastrum brevispinum* var. *canadense* n. var. Fig. 3. *Staurastrum chaetoceras*. Fig. 4. *Staurastrum crenulatum*. Fig. 5. *Staurastrum cuspidatum*. Fig. 6. *Staurastrum floriferum?* Fig. 7. *Staurastrum furcigerum*. Fig. 8. *Staurastrum granulosum*. Fig. 9. *Staurastrum orbiculare*. Fig. 10. *Staurastrum ornatum* var. *asperum*. Fig. 11. *Staurastrum paradoxum*. Fig. 12a, b, c. *Staurastrum peleii* n. sp. 12a, face view; 12b, upper surface of semicell; 12c, lower surface of semicell. Fig. 13. *Staurastrum polymorphum*. Fig. 14. *Staurastrum punctulatum* var. *kjellmanii*. Fig. 15. *Staurastrum sebaldi* var. *ornatum*. Fig. 16. *Staurastrum striolatum*. Fig. 17. *Staurastrum tetracerum*. Fig. 18. *Staurastrum setigerum*. Fig. 19a, b, c. *Staurastrum polytrichum* var. *ornatum*. n. var. Fig. 19a, face view; 19b, end view; 19c, detail of spine. Fig. 20. *Hyalotheca mucosa*. Fig. 21. *Desmidium swartzii*. Fig. 22. *Spondylosium luetkemulleri?* Fig. 23. *Sphaerozosma granulatum*.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somewhat questionable. Joshua (1885) discovered a plant from Pictou, Nova Scotia, which he referred to Corda's species and included it in the genus *Cosmarium*. His figure indicates that the wall was punctate. Turner, during the same year (1885), reported *Cosmarium cordanum* Bréb. from Nova Scotia. This was the same desmid as reported by Joshua as *Cos. viridis* (Corda) but in his description Turner states "Cell-coat lightly granular or punctate. End view circular." The West's in their British Desmidiaceae (1908) report the species and a forma *minor* West. Again the cell wall is described as punctate. The dimensions of West's forma *minor* are almost exactly those of the present material while in all recorded cases those of the species are distinctly greater. Also the vertical view of the species as well as of West's forma *minor* has been consistently reported as circular while the Ohio material is consistently compressed. Because of these differences the Lake Erie material has been given varietal rank.

Staurastrum Meyen 1829

Cells of variable size, usually as broad or broader than long, usually radially symmetrical, median constriction more or less deep; semicells variable in outline, with the angles frequently produced into elongate, hollow processes, 2–12 radiate in vertical view; cell wall smooth to granulate, or with variously arranged spines or verrucae; chloroplasts one per semicell, axial, with radiating lobes, and one pyrenoid.

1. *Staurastrum avicula* Bréb. var. *subarcuatum* (Wolle) W. West (Pl. IV, Fig. 16). L. 36–37μ, w. 38–40μ, isth. 9–10μ. Wehrle.
2. **Staurastrum biarcuus** Taft n. sp. (Pl. IV, Fig. 17). Semicells truncate- pyramidate, base convex, apex retuse, sides straight, sinus deep, rapidly opening outward; cell wall granulate, granules arranged in concentric series about the angles; each basal angle furnished with two vertically arranged teeth, the lower somewhat smaller than the one above; each apical angle furnished with a single, broad, conical granule. Vertical view triangular; each angle exhibiting a single tooth-like granule; sides straight or slightly convex, sharply retuse at the center. Within the vertical view formed by the basal angles, and an exact miniature, is the smaller vertical view of the apical angles. L. 35–36μ, w. 32–34μ, isth. 14μ. Kelleys Isl.

   Semicellulae truncato-pyrimidatae, basis convexa, apex retuses, lateres recti; sinus altus, rapide extra se pandens; murus cellulae granulatus, granulis in seriebus concentricis circum angulos dispositis; omnis angulus basalis duobus dentibus a vertice positis praeditus, inferiore paulo minore quam superiore; omnis angulus apicalis granulo singulo, lato, conicoque praeditus. A vertice visae triangulae; omnis angulus granulum singulum denti simile praebens; lateres recti aut aliquantum convexi, acute retusi ad centrum. In apsectu a vertice angulis basalicibus facto, et tabella minuta exacta, est aspectus minor a vertice angulorum apicalum. Long. 35–36μ, lat. 32–34μ, lat. isth. 14μ.

   This species should be compared to *St. paniculosum* Wolle which has two small teeth at the end of each basal angle. It differs from Wolle's species in its open instead of a closed sinus, the presence of granules on the upper angles, and the retuse sides in vertical view.
3. *Staurastrum bicoronatum* Johnson var. **tridentatum** Taft n. var. (Pl. V, Fig. 1). Apex of semicells distinctly elevated; each lateral process in vertical view with three short spines. L. 23μ, w. 38–43μ, isth. 4–6μ. East Harbor.

   Varietas type paullo major; semicellulis apicibus convexis; a vertice aspectae processibus lateralis cum tres spinis brevis. Long. 23μ; lat. 38–43μ; lat. isth. 4–6μ.

   This variety differs from the species by having three short instead of two long spines terminating each lateral process. The dimensions are also somewhat greater while the apex of the semicell is more convex. It differs from the variety described by West (1896) by having more ornamentations, and especially by the presence of the circularly arranged verrucae around the apex.
4. *Staurastrum bieneanum* Raben. (Pl. IV, Fig. 18). Cell wall finely granulate, two larger granules at each angle. L. 31–32μ, w. 30–34μ, isth. 7–8μ. Kelleys Isl.
5. *Staurastrum brevispinum* Bréb. var. **canadense** Taft n. var. (Pl. V, Fig. 2). This variety

differs from the species by having depressed-hexagonal semicells with rather acute lateral angles. Cell wall obscurely granulate. L. 46–48μ, w. 44μ, isth. 9–10μ. Pelee.

Haec varietas differt a typo semicellulis depresso-hexagonis, angulis lateralibus acutis. Membrana granulata obscure. Long. 46–48μ; lat. 44μ; lat. isth. 9–10μ.

6. *Staurastrum chaetoceras* (Schroeder) G. M. Smith (Pl. V, Fig. 3). L. plus processes 40–75μ, l. minus processes 18–25μ, w. plus processes 60–73μ, w. minus processes 14–16μ, isth. 4–7μ. Hatchery Bay.
7. *Staurastrum crenulatum* Delp. forma? (Pl. V, Fig. 4). L. 21μ, w. 23μ, isth. 5μ. Wehrle.
8. *Staurastrum cuspidatum* Bréb. (Pl. V, Fig. 5). L. 18–20μ, w. minus spines 16–18μ, isth. 4–5μ. Smith.
9. *Staurastrum floriferum* ? W. & G. S. West (Pl. V, Fig. 6). L. 34–46μ, w. plus processes 48–50μ, isth. 7–9μ. Wehrle, Smith, Haunk.

   The original figure of this species by West (1895) illustrates a specimen which was much less robust than any seen by the writer. The sculpturing of the wall, however, is nearly identical.
10. *Staurastrum furcigerum* Bréb. (Pl. V, Fig. 7). L. minus processes 41μ, w. plus processes 55–57μ, isth. 13u. Pelee.
11. *Staurastrum granulosum* (Ehren.) Ralfs (Pl. V, Fig. 8). L. 27–32μ, w. 25–32μ, isth. 10–14μ. Kelleys Isl.
12. *Staurastrum orbiculare* Ralfs var.? (Pl. V, Fig. 9). L. 42μ, w. 40μ, isth. 11μ. Pelee.
13. *Staurastrum ornatum* Turner var. *asperum* (Perty) Schmidle (Pl. V, Fig. 10). L. 26–28μ, w. 37μ, isth. 8–10μ. Pelee, East Harbor.
14. *Staurastrum paradoxum* Meyen (Pl. V, Fig. 11). L. minus processes 28–29μ, w. plus processes 53u, w. minus processes 12–15μ, isth. 7μ. Hatchery Bay.
15. **Staurastrum peleii** Taft n. sp. (Pl. V, Fig. 12). Cells of medium size, square or slightly rectangular in face view; sinus deep and closed; semicells horizontally rectangular, with three apical angles continued into two short, truncate, vertically arranged processes, basal angles broadly rounded and furnished with three concentric rows of granules, three granules of which show along each margin; vertical view of semicell triangular, each angle which represents the basal angle of the semicell broadly rounded, superimposed and projecting beyond this angle is the lower of the two vertically arranged processes, bearing at the margin three conical teeth and a row of three smaller granules within the margin, within this process is a bidentate protuberance corresponding to the upper of the two vertically arranged processes; basal view of the semicell triangular, angles broadly rounded, the margins furnished with one (rarely two) large conical teeth and two smaller granules on either side, and with two concentric rows of granules within the margin of either angle; sides in vertical view sharply retuse at the center. L. 37–39μ, w. 37–39μ, isth. 16μ. Pelee.

    Cellulae mediocres, quadratae aut aliquantum orthogoniae a fronte visae, sinu alto clausoque; semicellulae ad libram orthogoniae, tribus angulis apicales in dua prominentia brevia, truncata, a vertice disposita extentis, anguli basales late rotundati, tribus ordinibus concentricis granulorum praediti, ex quibus tria granula secundum utrumque marginem videri possunt; semicellula a vertice visa triangula, omne angulo, qui est idem cum angulo basale semicellulae, late rotundato, superimpositum et trans hunc angulum projectum est superius duorum prominentium a vertice dispositorum, tres dentes conicos et ordinem trium granulorum minorum in margine gerens, in hoc prominente est protuberatio bidentata superiori duorum prominentium a vertice dispositorum par; semicellula a basi visa triangula anguli late rotundati, margines uno aut raro duobus dentibus magnis conicisque et duobus granulis minoribus in utroque latere et duobus ordinibus concentricis granulorum in margine utrique anguli ornati, lateris a vertice visi in centro acute retusi. Long. 37–39μ, lat. 37–39μ, lat. isth. 16μ.
16. *Staurastrum polymorphum* Bréb. (Pl. V, Fig. 13). L. 28–30μ, w. 35–46μ, isth. 7–9μ. Haunk, Squaw Harbor, East Harbor.
17. *Staurastrum polytrichum* Perty var. **ornatum** Taft n. var. (Pl. V, Fig. 19). Cells slightly longer than broad, apices truncate instead of rounded; spines mostly curved, attached to

truncate, conical protuberances of the wall. Otherwise as in the species. L. minus spines 58μ, w. minus spines 55–57μ, w. plus spines 66–67μ, isth. 21μ, spines 4.5–5.5μ. Pelee.

Cellulae paulo longiores quam latae, apices truncati, non rotundati; spinae plerumque curvatae, protuberationibus truncatis conicisque muri aptae. Long. 58μ, lat. 66–67μ, lat. isth. 21μ.

18. *Staurastrum punctulatum* Bréb. var. *kjellmanii* Wille (Pl. V, Fig. 14). L. 39μ, w. 30μ, isth. 13μ. Kelleys Isl.
19. *Staurastrum sebaldi* Reinsch var. *ornatum* Nordst. (Pl. V, Fig. 15). L. 53μ, w. plus processes 96μ, w. minus processes 21μ, isth. 14μ. East Harbor.
20. *Staurastrum setigerum* Cleve (Pl. V, Fig. 18). L. 35–39μ, w. 39–46μ, isth. 11μ. Squaw Harbor, Wehrle, Haunk.

Somewhat smaller than usual, but with the typical arrangement of spines.

21. *Staurastrum striolatum* (Naeg.) Arch. (Pl. V, Fig. 16). L. 19–21μ, w. 18–23μ, isth. 8μ. Wehrle, Haunk, Smith, Kelleys Isl.
22. *Staurastrum tetracerum* Ralfs (Pl. V, Fig. 17). L. plus processes 25–27μ, l. minus processes 10–11μ, w. plus processes 28–30μ, w. minus processes 7–9μ, isth. 5μ. East Harbor.

Sphaerozosma Corda 1835

Cells small, flattened, deeply constricted, with an open sinus, united in long, twisted filaments by means of short apical appendages. One chloroplast and one pyrenoid in each semicell.

1. *Sphaerozosma granulatum* Roy & Biss. (Pl. V, Fig. 23). Cell length 9–10μ, w. 9–11μ, isth. 4–5μ. Smith.

Spondylosium Bréb. 1844

Cells flattened, often deeply constricted, sinus open, variable in shape, apices truncate, concave or convex. Vertical view elliptic, tumid-elliptic or triangular. Cells united by the apposition of the apices into filaments.

1. *Spondylosium luetkemuelleri?* Grönblad. (Pl. V, Fig. 22). Cells of medium size, deeply constricted, sinus open. Vertical view elliptic, slightly tumid on either side. Cell wall smooth. Chloroplasts axial, each with one pyrenoid.

These specimens have been doubtfully referred to *Spondylosium luetkemuelleri* on the basis of cell shape, size and chloroplast structure. Only two cells were seen and they were not united. Such peculiar shaped cells, if united in filaments, would dissociate readily. This may have happened in the writers collections.

Hyalotheca Ehren. 1840

Cells nearly cylindrical, length and breadth about the same, constriction broad and shallow, united into long filaments which are enclosed by a gelatinous sheath; each semicell with one axial chloroplast having radiating ridges and one pyrenoid.

1. *Hyalotheca mucosa* (Mert.) Ehr. (Pl. V, Fig. 20). Cell wall with two parallel rows of granules just within the apices. Filaments usually enclosed within a broad gelatinous sheath. Cell length 16–21μ, w. 18–20μ, isth. 16–18μ. East Harbor.

Desmidium Ag. 1824

Cells united in twisted filaments, usually with a broad gelatinous sheath, depressed, broader than long, with a distinct median constriction; 3–4 angled in vertical view (sometimes ovoid or citriform). One chloroplast and one pyrenoid in each semicell.

1. *Desmidium swartzii* Ag. (Pl. V, Fig. 21). Filaments triangular, twisted. Cell length 18μ, w. 44–46μ, isth. 37–41μ. East Harbor.

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